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(54) Transpiring sole structure for footwear

(57) Transpiring sole structure comprising a sole provided with holes (7, 8, 102, 202, 302, 402, 500) and means (11, 20, 107, 204 e 206, 205 e 207, 304 e 310, 305 e 311, 403 e 407, 502) which are selectively permeable to air but not to water, wherein said holes (7, 8, 102, 202, 302, 402, 500) open along all or part of the external edge of said sole (1, 2, 103, 200, 300, 400, 504) and open either into at least one cavity (25, 4, 105, 201 and 203, 301 and 303, 401) provided inside said sole (1, 2, 103, 200, 300, 400) or on the upper surface (501) of said sole (504), said means (11, 20, 107, 204 e 206, 205 e 207, 304 e 310, 305 e 311, 403 e 407, 502) which are selectively permeable to air but not to water being attached for hermetic closure of said holes.

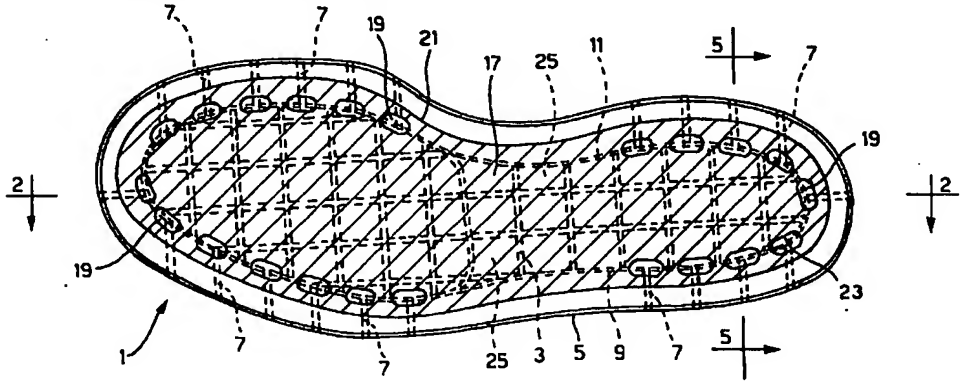

FIG. 1

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Description

[0001] The present invention relates to a structure of a sole which allows transpiration of the item of footwear whereon it is mounted. From the European patent EP 0382904 a transpiring sole structure is known, composed of a tread with through holes via its thickness, which holes are closed above by a microporous membrane which is selectively permeable to air but not to water.

[0002] This type of perforated sole allows the expulsion of stagnant air inside the footwear, but in actual fact its efficiency could be affected by the fact that the micro holes of the tread are subject to rapid blockage, therefore limiting or even preventing the passage of air through them.

[0003] From the European patent EP 479183 another type of transpiring sole structure is known where transpiration takes place through a band extending peripherically upwards from the outer edge of the tread.

[0004] In this solution provision is made for a second perforated band inside the first band, to be superimposed and attached to the latter by placing in between a microporous membrane which is selectively permeable to air but not to water.

[0005] This structure also has a grid of diaphragms separated by cracks, which grid, attached to the upper base of the tread, extends perimetrically with the above mentioned internal band.

[0006] The grid is necessary so that the internal band communicating with the interior of the footwear also in the area of the sole of the foot ensures the passage of air coming also from the sole of the foot.

[0007] The upper mounted on this sole structure must necessarily be made in a transpiring material in such a way as not to jeopardise transpiration through the portion of internal band attached thereto.

[0008] In this structure moreover, although the passage of air between the interior of the footwear and the outside environment is ensured, the microporous membrane, during use, is exposed to the risk of damage when one of its parts is uncovered due to wear or breakage of the external perforated band, which represents for it the only barrier for protection against the outside.

[0009] The process of manufacturing of a known this type of sole is often significantly more complex and expensive compared to normal practice.

[0010] In many case furthermore perspiration is only possible by using a sole which appreciably modifies the original design of the footwear, making it of little use in areas wherein great importance is placed on the shape and outline of the footwear.

[0011] The object of the present invention is that of remedying the problems suffered in traditional embodiments and in particular that of providing a structure of a sole which ensures efficient exchange of air between the interior of the footwear and the external environment, in any context.

[0012] A further object of the present invention is that of providing a transpiring sole structure which allows protection of the delicate microporous membrane which is selectively permeable to air but not to water.

[0013] Another object of the present invention is that of producing a transpiring sole structure which can be used universally for any type of upper, transpiring or non-transpiring, and for any type of sole, solid or "cellular".

[0014] Yet another object of the present invention is that of providing a structure of a sole whose device for transpiration does not substantially modify either the shape or the area of intended use of the shoe itself.

[0015] A further object of the present invention is that of providing a simplified transpiring sole structure, which for this reason has a low cost of manufacture.

[0016] All the foregoing objects are achieved by providing a perforated sole structure with means which are selectively permeable to air but not to water for transpiration in accordance with the present invention, wherein said holes open along all or part of the external edge of said sole and open into at least one cavity provided inside said sole or on the upper surface of said sole, said means which are selectively permeable to air but not to water being attached for water proofed of said holes.

[0017] Advantageously the present invention enables a transpiring sole structure to be produced without heavily modifying the original design of the sole, instead leaving it virtually unaltered when it is a cellular sole, the cells of the cellular structure being exploited directly for insertion of the means which are selectively permeable to air but not to water, and therefore only perforation of the external edge of the sole is necessary.

[0018] Perforation of the external edge of the sole allows excellent functioning of the mechanism of ventilation of the same, given that the holes cannot be clogged by dust or particles found on the ground.

[0019] The possibility of attaching the membrane for closure of the holes in a vertical position inside the sole, in the case wherein the holes open into cavities of the sole, enables the thick perforated layer of the sole itself to be exploited to protect the membrane from external agents.

[0020] The transpiring sole structure of the present invention can finally be applied universally to any type of sole, both a solid sole and a cellular type, and to any type of upper, in a transpiring or non-transpiring material, in that the air passes through the arch-support and the sole and does not involve the upper itself. This transpiring sole structure therefore can be used for any footwear model, from the classic type to a more sporty one.

[0021] The present invention may be understood better with the aid of the description of some preferred embodiments of the invention indicated hereinbelow, which must be read with reference to the accompanying drawings, wherein:

Fig. 1 shows a plan view of a transpiring cellular sole structure according to a first embodiment of the present invention;

Figs. 2 and 5 show a sectioned view of the sole structure of Fig. 1 along lines 2-2 and 1-1 respectively;

Fig. 3 shows a plan view of a transpiring solid sole structure according to another embodiment of the present invention;

Figs. 4 and 6 show a sectioned view of the sole structure of Fig. 3 along lines 4-4 and 3-3;

Figs. 7a and 7b show an enlarged perspective view, blown up, of the parts forming the element of the device for transpiration on insertion in the respective hole, and a schematic plan view of the sole according to another preferred embodiment.

Fig. 8a shows a plan view of a transpiring sole structure according to another embodiment of the present invention;

Fig. 8b shows the means which are selectively permeable to air but not to water, provided for the embodiment of Fig. 8a;

Fig. 9a shows a plan view of a transpiring sole structure according to another embodiment of the present invention;

Fig. 9b shows a perspective view and a sectioned plan view of the means which are selectively permeable to air but not to water, provided for the embodiment of Fig. 9a;

Fig. 10a shows another transpiring sole structure in accordance with the present invention, seen in a plan view;

Fig. 10b shows a sectioned view along line 10b-10b of the transpiring sole structure of Fig. 10a.

Fig. 10c shows an enlarged perspective view of the means which are selectively permeable to air but not to water, provided for the embodiment of Figs. 10a and 10b;

Fig. 11 shows a front sectioned view of another embodiment of the present invention wherein the holes of the sole open on the upper surface of the sole itself.

[0022] The shoe of Figs. 1, 2 and 5 comprises a sole 1 with a cellular structure 3 on whose outer edge 5 a series of through holes 7 is formed which open directly on the external lateral wall 9 of the perimetrical cells of the cellular structure 3.

[0023] Along the external lateral wall 9 of the perimetrical cells of the cellular structure 3, at the front part and the heel of the sole 1 wherefrom the through holes 7 exit, a strip 11 of Goretex™ 11 is attached, a material known to be selectively permeable to air but not to water, or the like.

[0024] It is in any case always possible, as an alternative solution, to close each hole 7 individually with a respective membrane of the same type of material.

[0025] In the present embodiment the upper edge 53 and lower edge 51 of the strip 11 are glued near the upper end 13 and lower end 15 of the external lateral walls of the perimetrical cells of the cellular structure 3. Another type of attachment can however be foreseen, provided that it guarantees total impermeability to water, for example by waterproofed stitching or sealing.

[0026] Naturally all those materials having its same properties can also be used, that is to say all those materials which counter the passage of water but not of air.

[0027] These materials can finally have a variable thickness as required in order to achieve the necessary strength.

[0028] On the sole 1 an arch-support 17 is fitted wherein a series of openings 19 are formed perimetrically at a fixed distance from its edge 21. This series of openings 19 allows the flowing of stagnant air from the chamber limited by the lateral walls of the upper (not shown) towards the selective membrane 11 and subsequently towards the external environment. More specifically every opening 19 formed on the arch-support 17 lies in a position above the internal end 23 of a corresponding hole 7 of the sole 1 in such a way that the air to be discharged is preferably conveyed into the cells 25 of the cellular structure 3 communicating with the through holes 7.

[0029] According to a variant of the cellular sole described above, it may be decided to perforate the lateral walls of all the cells of the cellular structure 3 in such a way that they are made to communicate one with the other, and to use a transpiring arch-support, in order to allow a passage of air between the whole area of the sole of the foot and the external environment through the holes formed in the edge of the sole.

[0030] In accordance with another embodiment proposed for a solid sole structure 2 and shown in Figs. 3, 4 and 6, in order to allow the selective passage of air a slot 4 is provided which penetrates vertically the thickness of the sole 2 in order to leave a mark on the upper surface of the sole 2 which runs parallel to the external edge 6 of the sole 2 itself.

[0031] Moreover, along the external edge 6 on a front portion and rear portion of the sole 2, holes 8 are formed consecutively and which open on the external lateral wall 10 of the slot 4 and which are covered by a strip 20 in Goretex™. Fixed at upper and lower edges on

wall 10 in such a way as to allow a water proof fixing.

[0032] In this case too an arch-support 12 is provided with openings 14 which perfectly superimpose the outline of the slot 4, in such a way that the air is directly channelled inside the slot 4 and therefore in an ideal position for being expelled to the outside.

[0033] According to yet another embodiment of the present invention, as illustrated in Figs. 7a and 7b, it is possible to obtain a transpiring sole structure by forming, starting from the external edge 100 of the cellular sole 103, a succession of holes 102 with a circular section which open on the external lateral wall 104 of the perimetrical cells 105 of the cellular structure so that the elements 107 with a cylindrical shape are hermetically inserted in the respective holes 102. Each element 107 comprises a hollow plug 106 having an external base 108 provided with micro holes 110 and an open internal base 112. An annular counter-plug 118 also forms part of the element 107, which is attached for water proofed closure of the internal end base 112 of each plug 106, interposing, between each plug 106 and the respective counter-plug 118, a layer 120 of material which is permeable to air but not to water, in the present case in Goretex™. Whereas the peripheral portions of the membrane are attached between the plug 106 and the corresponding counter-tap 118, the central portion of the membrane 120 itself, free from any impediment, can guarantee transpiration in optimum conditions.

[0034] This solution advantageously offers the possibility of removing individually each plug from the respective housing to perform cleaning, maintenance or exchange of the assembly of the plug-layer of material which is selectively permeable to air but not to water-counter-tap, without having to intervene directly on the overall structure of the sole, and therefore eliminates the disadvantage of having to replace the entire sole in the case of blockage or malfunctioning of one of its small parts.

[0035] Naturally the same principle applies to a solid sole, in which case the holes 102 open on the external lateral wall of the slot which extends parallel to the external edge of the solid sole itself.

[0036] According to another possible variant, if a solid sole is used, the holes 102 can be tilted upwards and open directly on the upper surface of the sole itself.

[0037] The transpiring sole structures illustrated in Figs. 8a-10c concern preferred embodiments of the invention wherein means are provided which are selectively permeable to air but not to water in the form of plugs covered in a microporous material which is permeable to air but not to water, to be inserted in a corresponding cavity provided in the internal area of the sole in such a way as to allow a water proofed closure of the internal end of the holes opening into the cavities themselves.

[0038] In Figs. 8a and 8b the structure of the sole 200 comprises a front cavity 201 wherein the holes 202 provided on the edge of the front pad of the sole 200 open, and a rear cavity 203 wherein the holes 202 provided on the edge of the rear part of the sole 200 open.

[0039] The front plug 204 and rear plug 205 have an identical outline and thickness to those of the corresponding cavities 201 and 203 and are made in a transpiring material.

[0040] The external lateral walls of the front plug 204 and the rear plug 205 respectively are covered by membranes 206 and 207 respectively, selectively permeable to air but not to water, and the edges of the membranes 206 and 207 respectively realise a water proof attachment onto the external lateral walls of the cavities 201 and 203 respectively, in such a way as to close the end of the holes 202 which opens into the cavities 204 and 205 respectively.

[0041] Attachment can be achieved for example by means of gluing, heat-sealing water proof stitching or by pushing the plugs 204 and 205 inside the respective housings 201 and 203 until a perfectly waterproof joint is achieved.

[0042] As an alternative solution the plugs 204 and 205 can have an internally hollow structure in a material which is still transpiring or perforated.

[0043] In Figs. 9a and 9b the transpiring sole structure 300 is provided with a pair of right and respectively left front cavities 301, wherein the holes 302 provided on the right and respectively left front part of the sole 300 open, and a pair of right and respectively left rear cavities 303, wherein the holes 302 provided on the right and respectively left rear part of the sole 300 open.

[0044] In this case the pairs of front plugs 304 and rear plugs 305, in perforated plastic or transpiring material, are internally hollow and also have the external lateral wall 306 and 307 and the upper wall 308 and 309 open to allow the passage of air between the perforated or transpiring arch-support (not shown) and the external environment through the membrane 310 and 311 which is selectively permeable to air but not to water and which covers the same external lateral wall 306 and 307 of the aforementioned front plugs 304 and rear plugs 305.

[0045] In Figs. 10a-c the transpiring sole structure 400 of a further embodiment of the present invention comprises, similarly to the solution illustrated in Figs. 1, 2 and 5, a cellular structure with communicating cells, the holes 402 opening on the external lateral walls of the perimetrical cells 401.

[0046] Unlike the embodiment illustrated in Figs. 1, 2 and 5, wherein on the external lateral walls of the cells a simply microporous membrane is simply attached, in the present embodiment provision is made for insertion of a plug 403 in each cell 401, each of which plugs 403 is a hollow cube with the lateral walls 404 and the upper wall 405 open.

[0047] Of all the plugs 403, only those relating to the perimetrical cells 401 of the cellular structure have the external lateral surface 406 covered with the microporous membrane 407, so as to block the entrance of

external water towards the interior of the cellular structure.

[0048] Also with this sole structure 400 the exchange of air via the whole sole of the foot is permitted, the structure being completed simply by placing on the sole a transpiring or perforated arch-support.

[0049] Naturally, as a variant solution, the plugs 403 can also be solid but in a transpiring material, and it is also possible to leave the central cells of the cellular structure free, maintaining in any case the air exchange mechanism unaltered.

[0050] What is referred in the previous embodiments must not restrict the more general principle claimed, it being possible for example for the holes to involve a portion or even the whole edge of the sole, for the shape and number of the cavities in the internal part of the sole to be different from those shown and consequently for the means which are selectively permeable to air but not to water to be different from those shown and consequently the means which are selectively permeable to air but not to water to have a different shape, structure and dimensions and such as to adapt to the cavity wherein they are inserted, without prejudice to the presence of one or more microporous membranes for closure of the holes for waterproofing the interior of the sole.

[0051] According to another embodiment of the present invention shown in Figure 11, the holes 500 of the sole 504 open directly on the upper surface 501 of the sole 504 itself.

[0052] A membrane 502 in Goretex™ or the like is superimposed and perimetrically attached to the outline 503 of the sole 504 by any waterproofed attachment technique chosen from among gluing, heat-sealing and stitching water proofed.

[0053] Naturally the holes 500 can be formed on a portion but also on the whole outer edge of the sole 504 and can extend inwards along a rectilinear path, as shown in Fig. 11, and also curved towards the upper surface 501 of the sole 504.

Claims

1. Transpiring sole structure comprising a sole provided with holes and means which are selectively permeable to air but not to water characterised in that said holes (7, 8, 102, 202, 302, 402) open along all or part of the outer edge of said sole (1, 2, 103, 200, 300, 400) and in that at least one cavity (25, 4, 105, 201 e 203, 301 e 303, 401) is provided inside said sole (1, 2, 103, 200, 300, 400) wherein said holes (7, 8, 102, 202, 302, 402) open, said means (11, 20, 107, 204 e 206, 205 e 207, 304 e 310, 305 e 311, 403 e 407) which are selectively permeable to air but not to water being attached for hermetic closure of said holes (7, 8, 102, 202, 302, 402).

2. Transpiring sole structure according to claim 1, characterised in that said means (11, 20, 204 e 206, 205 e 207, 304 e 310, 305 e 311, 403 e 407) which are selectively permeable to air but not to water attached for a water proof hermetic closure of said holes (7, 8, 202, 302, 402), are attached on the outlet of said holes.

3. Transpiring sole structure according to claim 1, characterised in that said means (107) which are selectively permeable to air but not to water, attached for a water proof closure of said holes (102), are attached inside said holes (102).

4. A transpiring sole structure according to claims 1 and 2, characterised in that said one cavity at least is in the form of a front cavity (201)wherein the holes (202) provided on the front part of the sole (200) open, and a rear cavity (203) wherein the holes (202) provided on the heel of the sole (200) open.

5. A transpiring sole structure according to claims 1 and 2, characterised in that said one cavity at least is in the form of a pair of right and respectively left front cavities (301), wherein the holes (302) provided on the right and respectively left front part of the sole (300) open, and a pair of right and respectively left rear cavities (303), wherein the holes (302) provided on the right and respectively left rear part of the sole (300) open.

6. A transpiring sole structure according to claims 1 and 2, wherein said sole is of the cellular sole type, characterised in that said one cavity at least is in the form of perimetrical cells (25, 105, 401)of said cellular sole (1, 103, 400), said series of holes (7, 102, 402) opening on the external lateral walls of said cells (25, 105, 401).

7. A transpiring sole structure according to the previous claim characterised in that passages are provided through the internal lateral walls of the internal cells of the cellular structure, said passages placing said cells in direct communication one with the other.

8. A transpiring sole structure according to claims 1 and 2, wherein said sole is of the solid sole type, characterised in that said one cavity at least is in the form of a slot (4), extending substantially parallel to the outer edge of said solid sole (2), said series of holes opening on the external lateral wall of said slot (4).

9. A transpiring sole structure according to any one of claims 4 to 8, characterised in that said means which are selectively permeable to air but not to

water are in the form of a strip (11, 20)of a microporous membrane which is permeable to air but not to water, covering the internal end of said series of holes (7, 8) which open inside said one cavity (25, 4) at least, said strip (11, 20) being attached to the external lateral wall of said one cavity (25, 4) at least by any known technique chosen from among gluing, sealing and waterproofed stitching.

10. A transpiring sole structure according to any one of claims 4 to 8, characterised in that said means which are selectively permeable to air but not to water are in the form of a series of microporous membranes which are permeable to air but not to water, each membrane of said series of membranes covering the internal end of a corresponding hole (7, 8) of said series of holes which open in said one cavity (25, 4) at least, said series of membranes being attached to the external lateral wall of said one (25, 4) cavity at least by any known technique chosen from among gluing, sealing and waterproofed stitching.

11. A transpiring sole structure according to any one of claims 4 to 8, characterised in that said means which are selectively permeable to air but not to water are in the form of at least one plug (204 and 205, 304 and 305, 403) provided at said one cavity (201 and 203, 301 and 303, 401) at least, said one plug (204 and 205 304 and 305, 403) at least having an external shape identical to said one corresponding cavity (201 and 203, 301 and 303, 401) at least so as to be inserted perfectly therein, and in that the external lateral wall of said one plug (204 and 205, 304 and 305, 403)at least in contact with the external lateral wall of said one corresponding cavity (201, 203, 301 and 303, 401) at least is covered with a microporous membrane (206 and 207, 310 and 311, 407) which is selectively permeable to air but not to water.

12. A transpiring sole structure according to the previous claim, characterised in that said one plug (204 and 205)at least is made in a material which is permeable to air but not to water so as to allow a passage of air from and to the external environment.

13. A transpiring sole structure according to claim 11, characterised in that said one plug (304 and 305, 403)at least is hollow internally and has at least the external lateral wall and the upper wall perforated to allow a passage of air from and to the external environment.

14. A transpiring sole structure according to claims 11 to 13, characterised in that said membrane (206 and 207), 310 and 311, 407) which is selectively permeable to air but not to water and which covers the external lateral wall of said one plug (204 and 205, 304 and 305, 403) at least is attached to said lateral wall of said one corresponding cavity (201 and 203, 301 and 303, 401) at least by any technique chosen from among gluing, heat-sealing, water proofed stitching or water proof thrust joint.

15. A transpiring sole structure according to claims 1 and 3, characterised in that said means which are selectively permeable to air but not to water are in the form of a series of elements (107) for transpiration corresponding to said series of holes (102), each element (107) of said series of elements (107) comprising an assembly of a first, a second and a third part, said first part being in the form of a hollow plug (106) with open internal base (112) and microperforated external base (108), and having such a shape so as to adapt to the corresponding hole wherein it is hermetically inserted, said second part being in the form of a layer (120) of material which is selectively permeable to air but not to water, to be placed for a water proof closure of said open internal base (112), said third part being in the form of a counter-plug (118), axially open and inserted in said plug (106) to block said layer between the internal lateral wall of said plug and the external lateral wall of said counter-plug (118).

16. A transpiring sole structure according to any one of the previous claims, characterised in that an arch-support, transpiring or perforated above, is provided, attached to the sole, wherein when said arch-support is perforated, the holes must involve at least the area above said one cavity (25, 4, 105, 201 e 203, 301 e 303, 401) at least.

17. A transpiring sole structure comprising a sole provided with holes and means which are selectively permeable to air but not to water, characterised in that said holes (500) open along all or part of the external edge of said sole and in that said holes open directly on the upper surface (501) of said sole (504), said means which are selectively permeable to air but not to water being attached for a water proof hermetic closure of said holes (500).

18. A transpiring sole structure according to the previous claim, characterised in that said holes (500) opening directly on the upper surface (501) of said sole (504) are covered by said means which are selectively impermeable to air but not to water formed by a membrane (502) in material which is selectively impermeable to air but not to water, perimetrically attached onto the outline of the upper surface (501) of the sole (504) by any technique chosen from among gluing, sealing and waterproofed stitching.

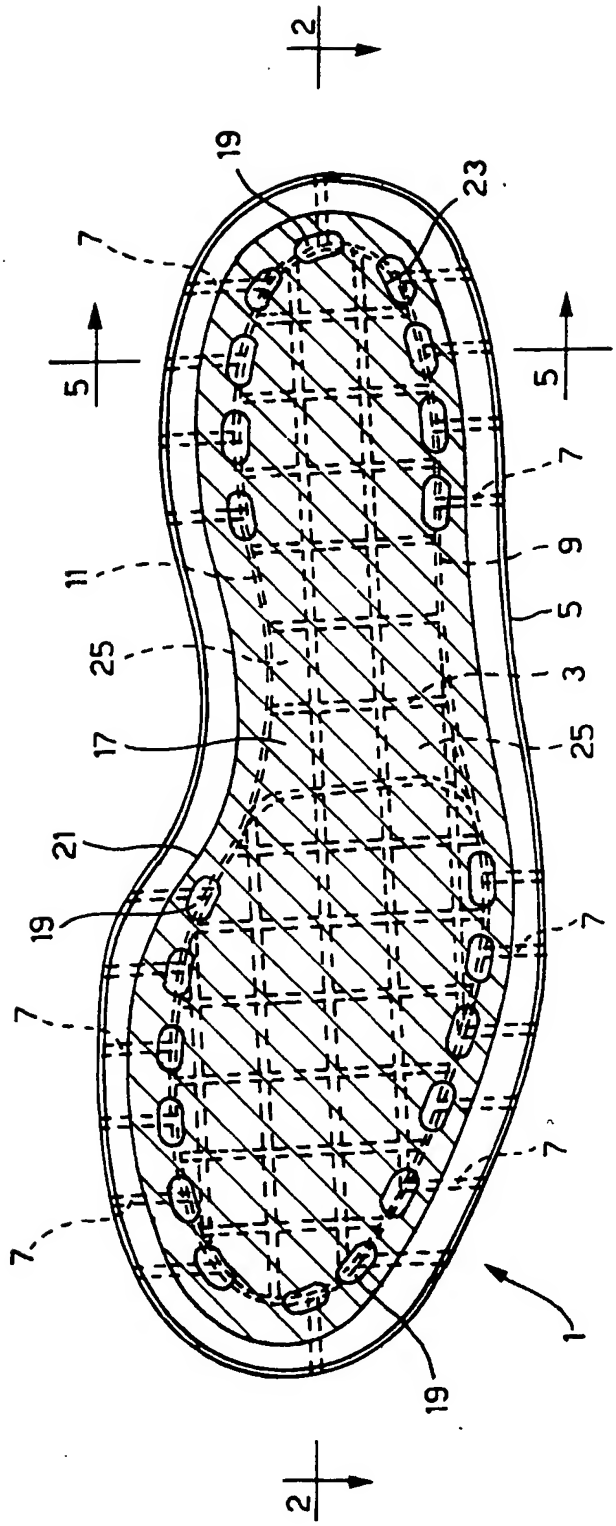
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FIG. 1

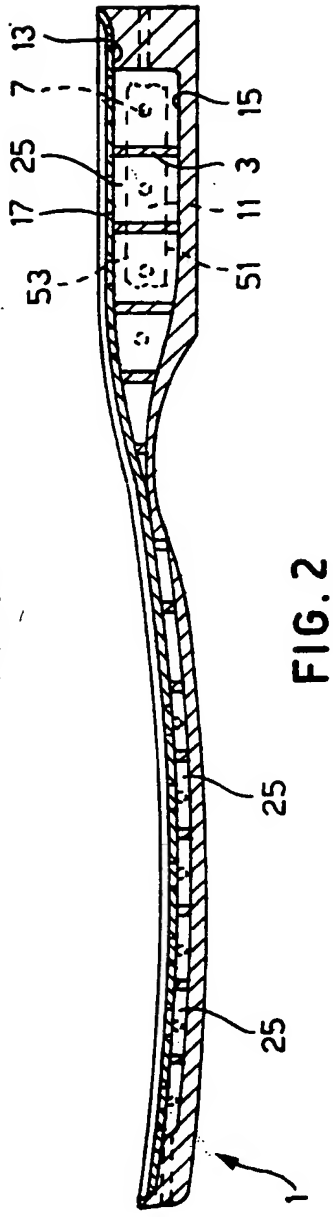
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FIG. 2

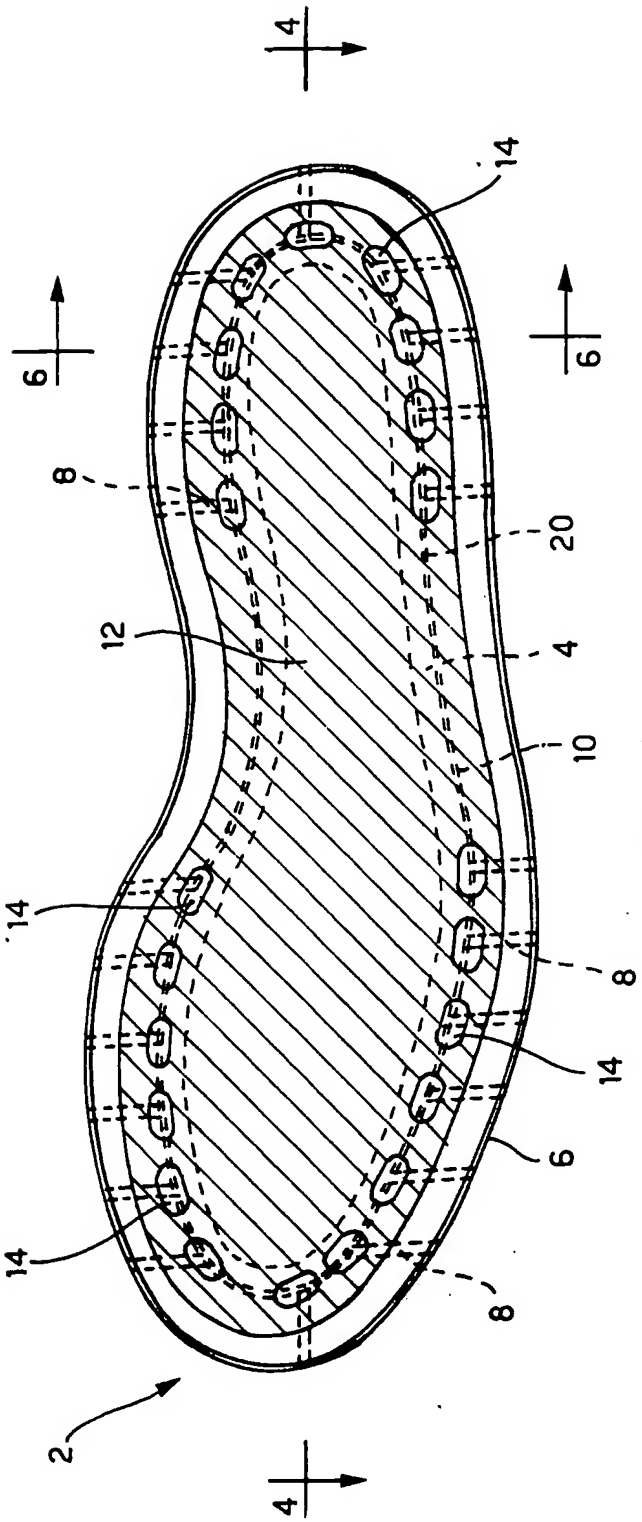

FIG. 3

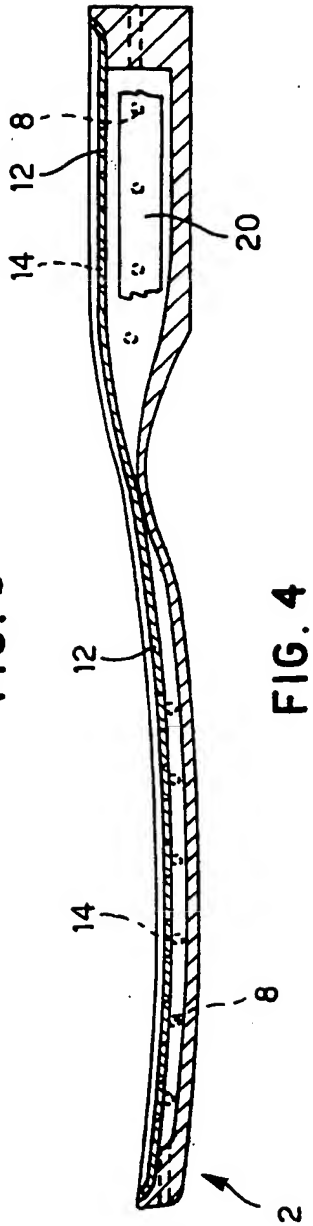

FIG. 4

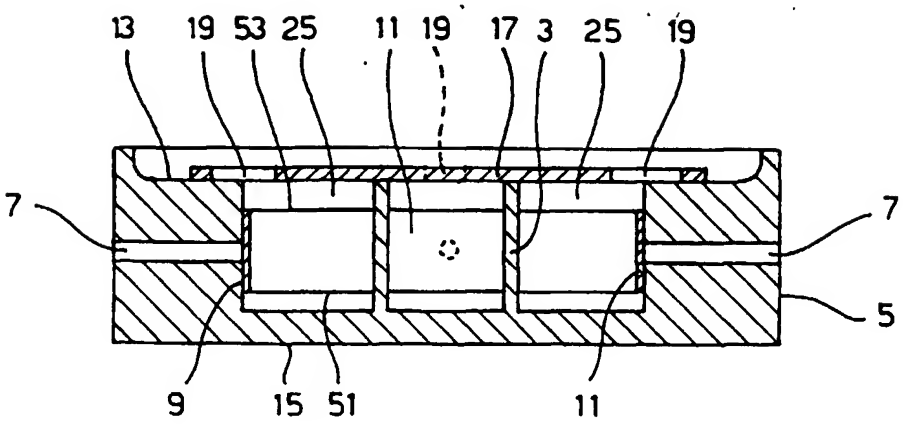

FIG. 5

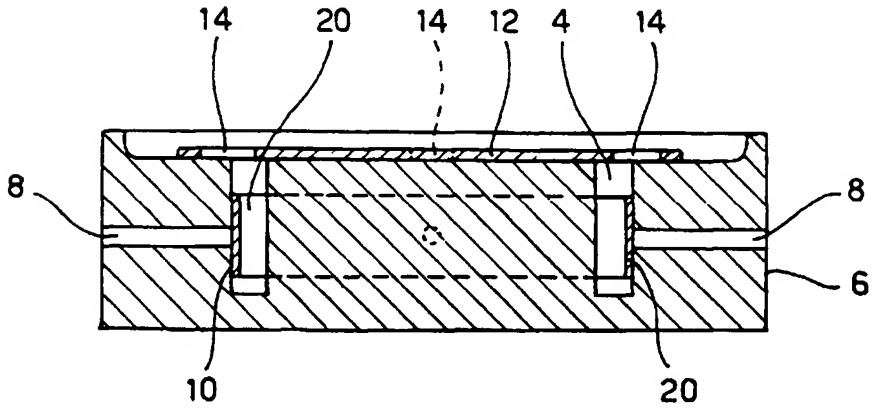

FIG. 6

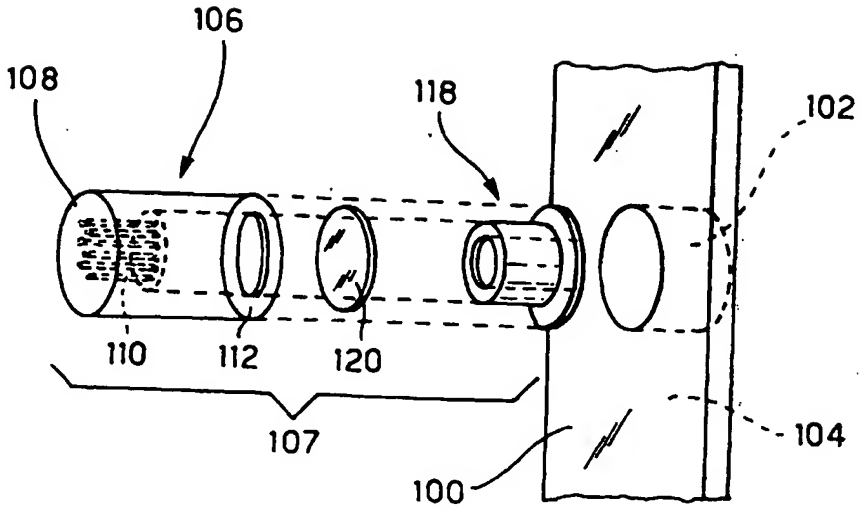

FIG. 7a

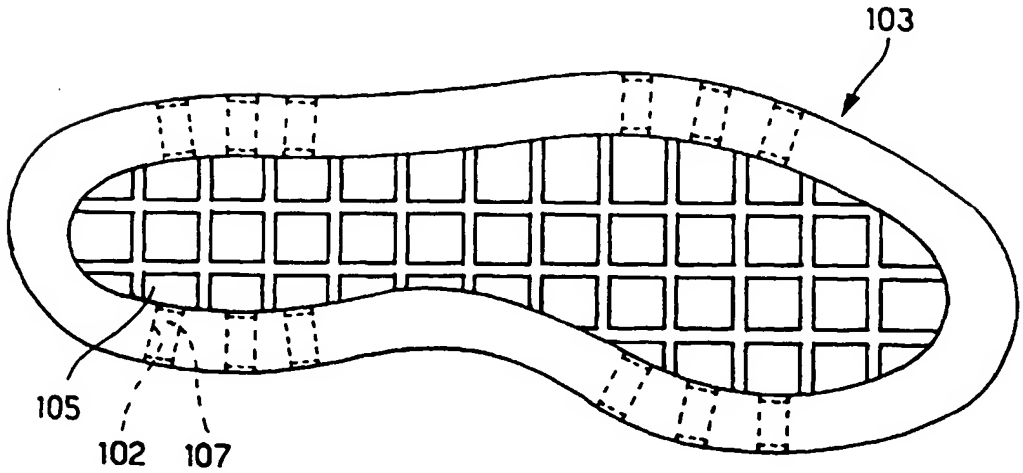

FIG. 7b

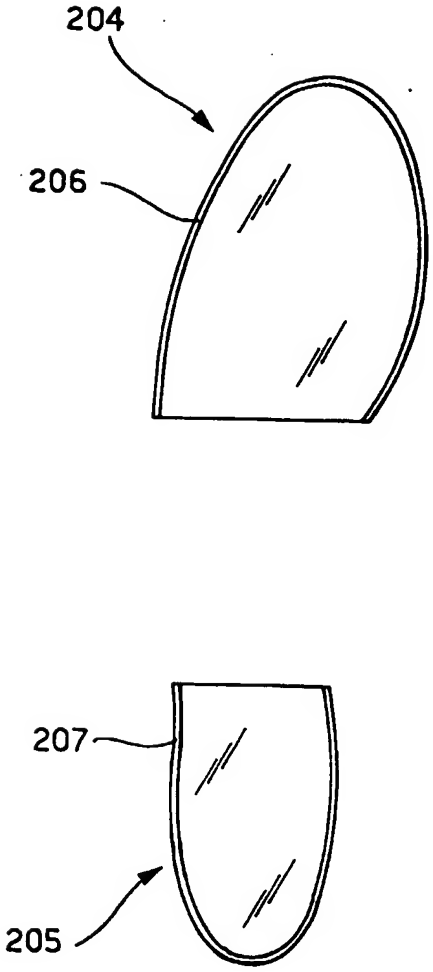

FIG. 8 b

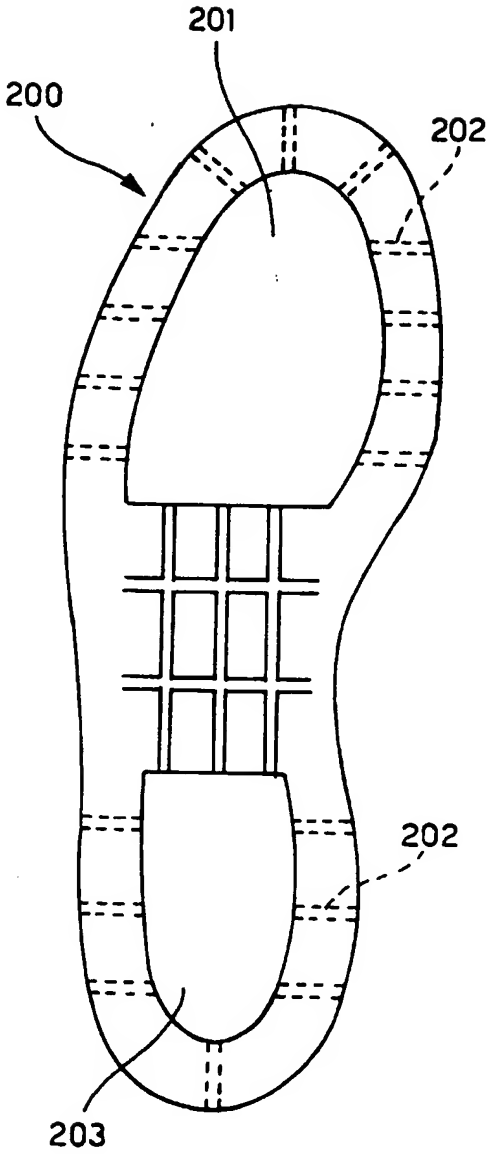

FIG. 8 a

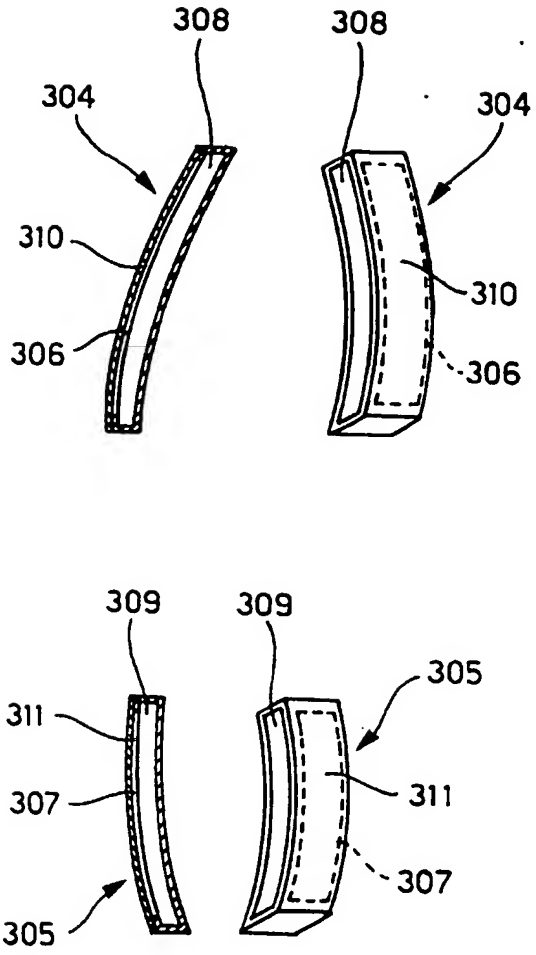
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FIG. 9 b

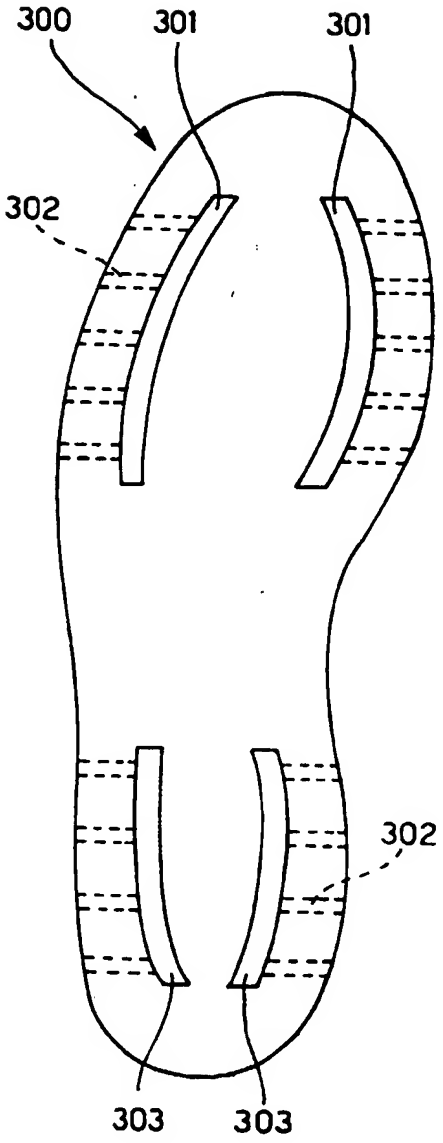
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FIG. 9 a

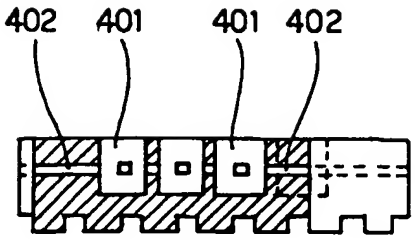

FIG. 10 b

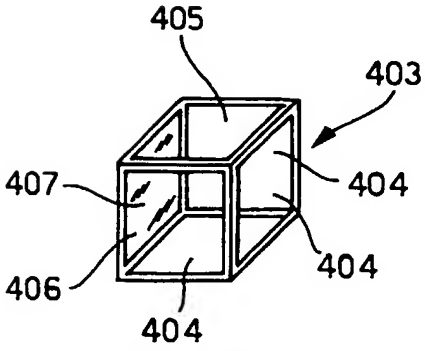

FIG. 10 c

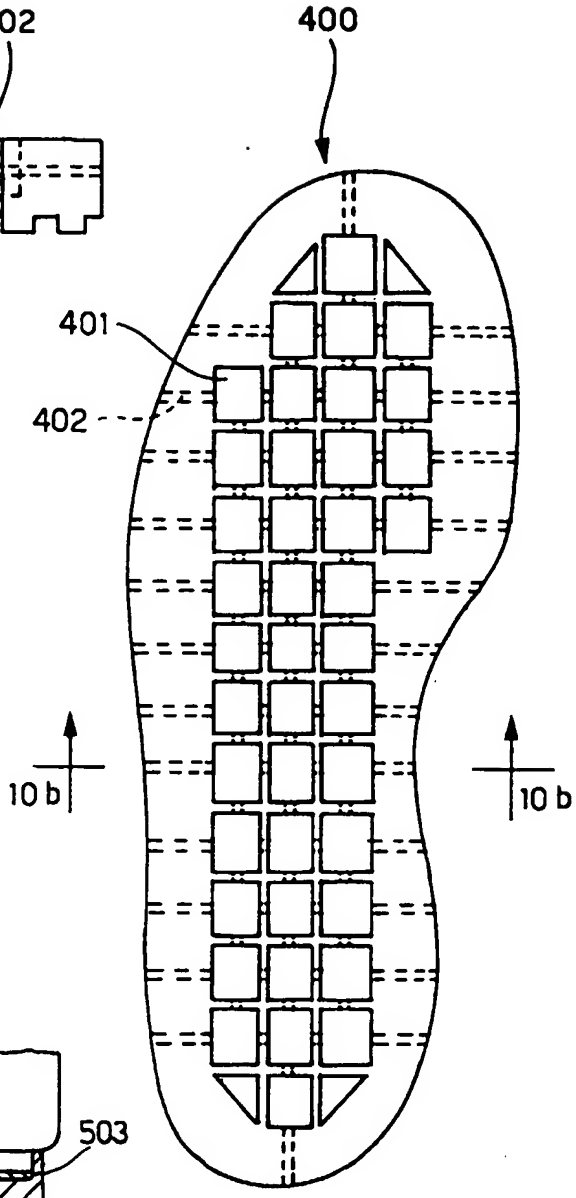

FIG. 10 a

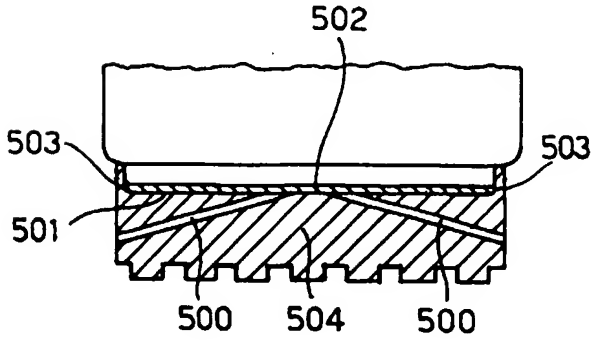

FIG. 11